

HAND-HELD ELECTRONIC TOY

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Background of the Invention

[1001] This invention relates generally to hand-held electronic toys, and more particularly to hand-held electronic toys having screens that enable user interaction.

[1002] Hand-held electronic toys that incorporate visual sensory elements have become immensely popular. In the gaming arena, these hand-held electronic toys produce a high-level of sensory stimulation and interactivity. This combined with their inherent portability has created a new form of child entertainment. Beyond the gaming arena, it is believed that hand-held electronic toys can also be used to promote intellectual and tactile creativity.

Summary

[1003] The present invention provides a hand-held electronic toy that can be used in creativity and learning activities. The hand-held electronic toy exposes a tool interface that can be dynamically changed based on characteristics of the activity that is being displayed on the hand-held electronic toy.

Brief Description of the Drawings

[1004] FIG. 1 is a front view of an embodiment of a hand-held electronic toy.

[1005] FIG. 2 is an embodiment of a toolbar menu.

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- [1006] FIG. 3 is an embodiment of a pop-up menu box.
- [1007] FIG. 4 is an operational flowchart of a hand-held electronic toy.
- [1008] FIG. 5 is an embodiment of an activity menu.
- [1009] FIG. 6 is an embodiment of a microprocessor control portion of a hand-held electronic toy.
- [1010] FIG. 7 is an embodiment of a liquid crystal display and touch panel control portion of a hand-held electronic toy.
- [1011] FIG. 8 is an embodiment of an expansion cartridge.
- [1012] FIG. 9 is a second embodiment of an expansion cartridge.

Detailed Description

[1013] An embodiment of the invention is discussed in detail below. While specific implementations are discussed, it should be understood that this is done for illustration purposes only. A person skilled in the relevant art will recognize that other components and configurations may be used without departing from the spirit and scope of the invention.

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[1014] FIG. 1 is a front view of an embodiment of hand-held electronic toy 100. Hand-held electronic toy 100 includes screen 110 that enables visual sensory output and user interaction. User interaction is effected through drawing stylus 120. In one embodiment, screen 110 is a liquid crystal display (LCD) based, touch screen.

[1015] System software drives the functionality of hand-held electronic toy 100 and enhances play with sound and animation. In the illustrated embodiment, hand-held electronic toy 100 can also include expansion cartridge 130 that can be attached to hand-held electronic

toy 100 via an expansion port. In general, expansion cartridge 130 enables hand-held electronic toy 100 to expand its functionality to a multitude of additional creativity and learning activities.

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[1016] As further illustrated in the embodiment of FIG. 1, screen 110 includes printed toolbar menu 112. Toolbar menu 112 includes a set of basic menu tools that are selectable using stylus 120. As will be described in greater detail below, the functionality of the menu tools can change depending on an activity that has been selected as well as the state of the activity being run.

[1017] FIG. 2 is a detailed view of printed toolbar menu 112. In the illustrated embodiment, toolbar menu 112 includes nine selectable icons 201-209.

[1018] Selectable icon 201 is associated with a pencil tool for free-form drawing. Selection of icon 201 enables the user to draw with a single pixel width line on screen 110.

[1019] Selectable icon 202 is associated with a straight line tool for drawing straight lines of different thickness. Selection of icon 202 will call up a pop-up menu box. An embodiment of a pop-up menu box 300 is illustrated in FIG. 3. In the illustrated embodiment, pop-up menu box 300 offers the user two choice icons 310 and 320. Choice icon 310 will enable selection of a thin (1-pixel width) straight line, while choice icon 320 will enable a selection of a thick (3-pixel width) straight line.

[1020] Selectable icon 203 is associated with a shapes tool. Selection of icon 203 will call up a pop-up menu box. In one embodiment, the pop-up menu box offers the user his/her choice of a square drawing tool, a circle drawing tool, a triangle drawing tool, or a polygon drawing tool. These tools draw the shapes in outline form. The square, circle and triangle

tools “click-drag” the shape to various sizes, while the polygon tool will connect points with straight lines.

[1021] Selectable icon 204 is associated with a stamper tool. Selection of icon 204 will call up a pop-up menu box that offers the user a stamper selection set. The stamper selection set can include a variety of objects (e.g., animals) that can be “stamped” onto a scene visible on screen 110.

[1022] Selectable icon 205 is associated with an eraser tool. Selection of icon 205 will call up a pop-up menu box that offers the user his/her choice of a thin selective erase free-form line or a thick selective erase free-form line.

[1023] Selectable icon 206 is associated with a full screen erase tool. Selection of icon 206 will call up a pop-up menu box that allows the user his/her choice of several animated full-screen erase effects, such as a full screen erase with radiating lines from center (like ripples in a pond starting at center, accompanied by an explosion sound), a full screen erase with dissolve fade (like a static pattern slowly fading away, accompanied by a scratching sound), a full screen erase with a small “screen-eating” bug, accompanied by a munching sound), or a full screen erase with toilet flush swirl (slowly swirling inwards towards a central hole, accompanied by a whistle-slide down sound).

[1024] Selectable icon 207 is associated with a special effects tool. Selection of icon 207 will call up a pop-up menu box that enables various animated filters and effects such as a reverse-out effect that changes pixels from one state to the opposite state (ON/OFF) when screen 110 is touched, a rotate 90 degrees effect that rotates the whole screen by 90-degree increments when screen 110 is touched, a mirror x effect that copies/mirrors the whole screen

by 180 degrees symmetrically across the x-axis, and a mirror y effect that copies/mirrors the whole screen by 180 degrees symmetrically across the y-axis.

[1025] Selectable icon 208 is associated with a save file tool that enables saving and recalling files from memory.

[1026] Finally, selectable icon 209 is associated with a home button. Selection of icon 209 will call up the activity menu box.

[1027] In general, selectable icons 201-209 on toolbar menu 112 provide the user with access to a core set of tools that can be applied to various activities. These activities may be supported by the base system software or may be supported by expansion cartridge 130. The core set of tools represents a significant point of interaction and familiarity for the user of hand-held electronic toy 100. In particular, it is believed that the user will be more familiar with the core set of tools as opposed to the particular activities to which the core set of tools will be applied. This results because the tools are portable across a variety of activities. While the particular application of the tools to the various activities can vary, the core functional aspect of the tools themselves will be left relatively unchanged.

[1028] For example, the stamper tool can be applied to a variety of drawing activities. While the basic functionality of the stamper tool would be left unchanged, the set of stamps in the pop-up menu box from which the user can choose would be dependent upon the characteristics of the drawing activity.

[1029] It is a feature of the present invention that characteristics of the tools that can be invoked using selectable icons 201-209 on toolbar menu 112 are dependent on the identity and/or state of the activity to which it is being applied. This feature enables the core set of

tools to be flexibly and appropriately applied to the particular activity. To illustrate this aspect of the present invention, a description of an embodiment of the operation of hand-held electronic toy 100 is provided.

[1030] The high-level operation of hand-held electronic toy 100 is described with reference to the flowchart of FIG. 4. As illustrated, the process begins at step 402 when hand-held electronic toy 100 is powered on. At step 404, the hand-held electronic toy 100 identifies an applicable read-only memory (ROM). More specifically, hand-held electronic toy 100 determines whether an expansion cartridge 130 has been inserted into hand-held electronic toy 100. If an expansion cartridge 130 has not been inserted, then the activities of the base system software are presented to the user. If an expansion cartridge 130 has been inserted, then the activities supported by the inserted expansion cartridge are presented to the user. An example of an activity menu is illustrated in FIG. 5, which illustrates the menu of activities supported by the base system software.

[1031] At step 406, the activity menu is presented to the user. As illustrated, activity menu 500 includes activity selections 510, 520, 530, 540. Selection 510 is associated with a free drawing activity starting with a blank screen, selection 520 is associated with a scene starter activity that allows the user to select from several starter scenes, selection 530 is associated with a funny faces activity that allows the user to select from several starter funny faces, and selection 540 is associated with a connect-the-dots activity that allows the user to select from several connect-the-dots drawings.

[1032] At step 408, hand-held electronic toy 100 determines whether the user has selected an activity using stylus 120. If no activity has been selected it is then determined at

step 410 whether a timeout period (e.g., 60 seconds) has expired. If the timeout period has not expired, then hand-held electronic toy 100 will continue to wait for the user's selection of an activity. Conversely, if the timeout period has expired, hand-held electronic toy 100 will power off at step 412.

[1033] If it is determined at step 408 that one of activities 510, 520, 530, 540 has been selected from activity menu 500, then the selected activity is launched at step 414. In general, the particular activity that is selected may dictate that a particular tool set functionality is required. For example, some tools may be appropriate for a drawing activity, but not appropriate for a gaming activity. This calibration of tool functionality to the selected activity is accomplished at step 416, where hand-held electronic toy 100 sets the functionality of tools associated with icons 201-209.

[1034] As described above, the tools that are associated with icons 201-209 on toolbar menu 112 represent a significant point of interaction and familiarity for the user of hand-held electronic toy 100. These tools represent the user's knowledge base that governs the interaction with the activities that are run on hand-held electronic toy 100.

[1035] Significantly, the various activities that are capable of being run on hand-held electronic toy 100 cover a wide-range of creativity and learning exercises. As noted, in one embodiment, the base system software can include a free-drawing activity, a scene-starter activity, a funny-faces activity, and a connect-the-dots activity. As would be appreciated, various other activities can be provided using expansion cartridges 130. For example, expansion cartridges 130 can be provided that enable game activities (e.g., BINGO, Tic-Tac-

Toe, Concentration, Mazes), animal-discovery activities, learning activities (e.g., letters and numbers), animation activities, story-composer activities, etc.

[1036] Users of hand-held electronic toy 100 will interact with the wide range of activities in a variety of ways. For example, compare the differences in interaction that would be used in a free-drawing activity and in a concentration-game activity. In the free-drawing activity, all of the tools that are associated with icons 201-209 on toolbar menu 112 can be utilized. The user would be permitted to use the pencil tool, the straight-line tool, the shapes tool, the stamper tool, the eraser tool, the full-screen-erase tool, the special-effects tool, and the save tool in creating a drawing image. In the concentration-game activity, on the other hand, those drawing tools would be unnecessary. Interaction with the concentration game would be limited to the selection of tiles or cards to identify matching tiles or cards. Thus, in this activity, the tools associated with icons 201-208 on toolbar menu 112 would be inactivated. If the user selects one of icons 201-208 using stylus 120, an error tone would be played by hand-held electronic toy 100 signaling the selection of an inactivated tool. As would be appreciated, in various other activities, all or part of the set of tools associated with icons 201-208 can be inactivated for the activity that has been selected by the user.

[1037] The differences in interaction with particular activities can also be evident in the selectable options that are provided for a tool that is being used for the selected activity. For example, compare the difference in the selectable options that are provided for a stamper tool when used in a free-drawing activity and when used in a funny-faces activity. In a free-drawing activity, the user begins with a blank drawing screen. Selection of icon 204 would call up a pop-up menu box that offers the user a stamper selection set. In one embodiment,

this stamper selection set would include stamps of general interest, such as animal stamps, sporting object stamps, etc. In the funny-faces activity, on the other hand, a pop-up menu box would offer the user a stamper selection set that would include face-related stamps such as eye, nose, ears, and moustache stamps.

[1038] The difference in the selectable options presented in the pop-up menu box represents one example of a characteristic of a tool that can be modified for a particular activity. In general, it is envisioned that any characteristic that governs some aspect of usability for the tool can be modified based on the particular activity that has been selected by the user.

[1039] As described, characteristics of tools associated with icons 201-209 can be modified based on an identity of the activity that has been selected. It should also be noted that characteristics of tools associated with icons 201-209 can also be modified based on a state of interaction with a particular activity. For example, consider the types of interaction that can be used in a scene-starter activity. As noted, the scene-starter activity allows the user to select from several starter scenes. For example, starter scenes such as beach or space starter scenes can be selected through the use of browser arrow buttons that enable scrolling through the set of available starter scenes.

[1040] Tools associated with icons 201-209 can be modified based on the starter scene that is currently displayed. For example, the stamper tool associated with icon 204 can be modified based on whether a beach-starter scene or a space-starter scene is displayed. If the beach-starter scene is selected, then selection of icon 204 would present a pop-up menu box

of beach-related stamps. On the other hand, if the space-starter scene is selected, then selection of icon 204 would present a pop-up menu box of space-related stamps.

[1041] Again, as noted above, the difference in the selectable options presented in the pop-up menu box represents one example of a characteristic of a tool that can be modified based on a state of interaction with a particular activity. Any characteristic that governs some aspect of usability for the tool can be modified based on the state of interaction with a particular activity.

[1042] As thus described, the dependence of the characteristics of the tools on the identity and/or state of the activity to which it is being applied enables the core set of tools to be flexibly and appropriately applied to the various activities. This flexible application ensures that the user is presented with a consistent set of interactive tool functions.

[1043] FIG. 6 illustrates a hardware embodiment of hand-held electronic toy 100. This hardware embodiment includes LCD controller 610. In one embodiment, LCD controller 610 is the SPL130A 128KB LCD controller manufactured by Sunplus Technology Company Limited. In general, LCD controller 610 is a microprocessor that includes random access memory (RAM) and ROM that are used to store data and program information. LCD controller 610 also includes programmable I/Os that enable the driving and communicating with other components.

[1044] In the illustrated embodiment, two interfaces 620 and 630 are shown. Interface 630 enables communication with expansion cartridge 130. Interface 620, on the other hand, enables communication and control with the LCD display and touch panel. Interface 620 includes interface portions 622 and 624. Interface portion 622 is configured for

communication of touch panel coordinate information (x1, x2, y1, y2), while interface portion 624 is configured for communication of LCD control information.

[1045] FIG. 7 illustrates an embodiment of control elements associated with LCD display 710 and touch panel 720. As illustrated, touch panel 720 is coupled to interface portion 622 for communication of touch panel coordinates (x1, x2, y1, y2).

[1046] LCD display 710 is driven by LCD controllers 712, 714. In one embodiment, LCD controllers 712, 714 are the SPLD80A LCD controllers manufactured by Sunplus Technology Company Limited. In general, LCD controllers 712, 714 are versatile dot matrix LCD drivers that convert serial data to parallel data and output LCD waveform data to LCD display 710. As illustrated, two LCD controllers 712, 714 are used to drive the rows and columns of LCD display 710.

[1047] Referring again to FIG. 6, it was noted that interface 630 enables communication with expansion cartridge 130. FIG. 8 illustrates an embodiment of expansion cartridge 130. Expansion cartridge 130 includes bus extender 810 and external ROM/SRAM 820. In one embodiment, bus extender 810 is the Sunplus bus extender, SPBA01A, which expands RAM or ROM up to 4M bytes. This expansion of memory enables additional activities to be added to the base software system, thereby expanding the creativity and learning applications that are available to the user of hand-held electronic toy 100.

[1048] FIG. 9 illustrates a second embodiment of expansion cartridge 130. In this embodiment, expansion cartridge 130 includes bus extender 810, external ROM/SRAM 820 as well as RAM 910. The addition of RAM 910 can be used in activities that require additional dynamic memory, such as for animation effects.

[1049] It should be noted that in a further embodiment, expansion cartridge 130 can also be configured to include a microprocessor element as well. In this embodiment, when expansion cartridge 130 is inserted into hand-held electronic toy 100, the microprocessor in expansion cartridge 130 would take control and instruct LCD controllers 712, 714 what to display on LCD display 710.

[1050] While the invention has been described in detail and with reference to specific embodiments thereof, it will be apparent to one skilled in the art that various changes and modifications can be made therein without departing from the spirit and scope thereof. For example, in the description above, expansion cartridges are described as a vehicle for receiving activity information into the hand-held electronic toy. More generally, it should be noted that the hand-held electronic toy can be configured such that activity information can be received from a second hand-held electronic toy, the Internet, or any other information source. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

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